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INT CL^6 G06C 29/00 , G06F 13/38 , H04B 1/03 1/034 1/38 1/40 , H04L 12/28 12/56 , H04N 1/00 1/32 , H04Q 7/22 7/32 , H05K 11/00
ONLINE : WPI

(54) **IC card radio modem operable on a plurality of types of infrastructure network**

(57) An IC card unit 1 of the radio modem has a PCMIA interface (13, Fig. 2) coupled via a first connector 11 received in a card insertion slot of a system unit 3 (eg. a personal computer), a memory (16) for storing infrastructure type information, and an infrastructure-compatible interface (15) coupled via a second connector 12 received in an insertion slot in a modem main body package 2 housing a plurality of radio units 10A to 10N compatible with different types of infrastructure network, such as facsimile and cellular phone networks. A polling sequence (Fig. 4) is performed when requested by an IC card controller (14, Fig. 2) in card unit 1 to confirm whether the units 10A to 10N are connected. In response to the system unit 3 issuing a data communication start command and a designation of the network type to be used, an appropriate one of the units 10A to 10N is selected for communication as a result of comparison between the information in the IC card memory (16) and read out of infrastructure information of the actually connected units 10A to 10N. Selection may be such that an infrastructure which allows the highest data speed, or lowest cost, is used.

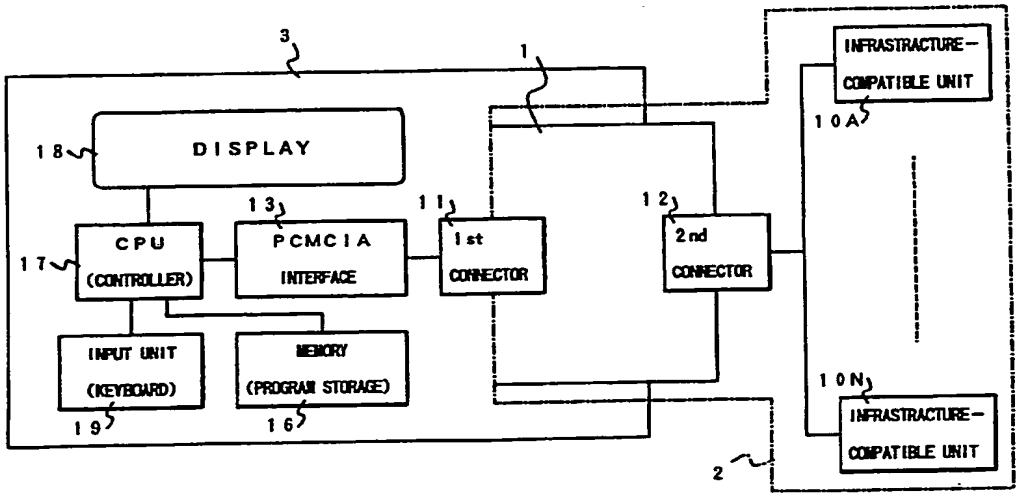

FIG. 1

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FIG. 1

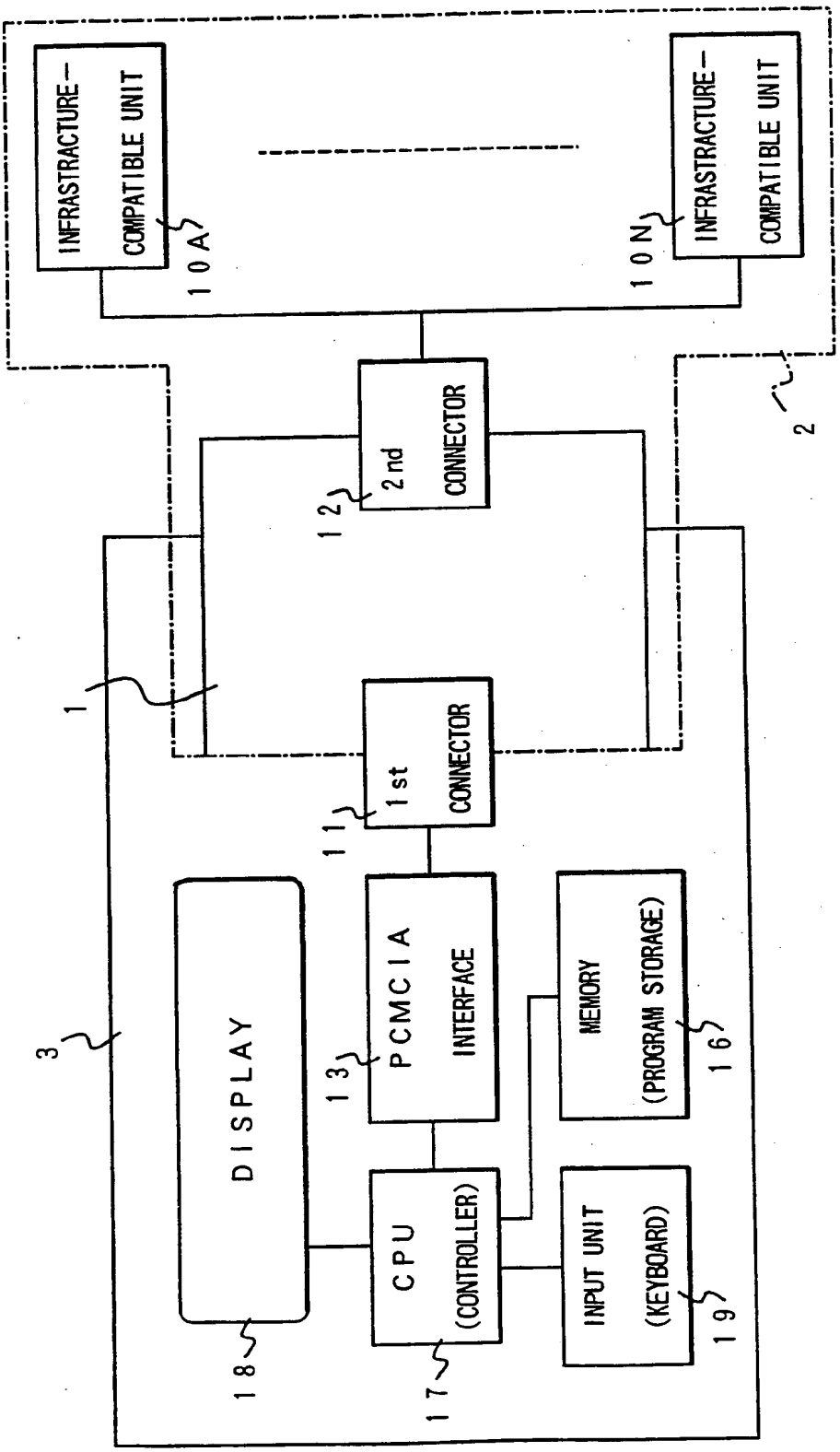

INFRASTRACTURE-COMPATIBLE UNIT
10A
10N
INFRASTRACTURE-COMPATIBLE UNIT
2nd CONNECTOR
12
2
1
1st CONNECTOR
11
DISPLAY
18
PCMCIA INTERFACE
13
MEMORY (PROGRAM STORAGE)
16
3
CPU (CONTROLLER)
17
INPUT UNIT (KEYBOARD)
19

FIG. 2

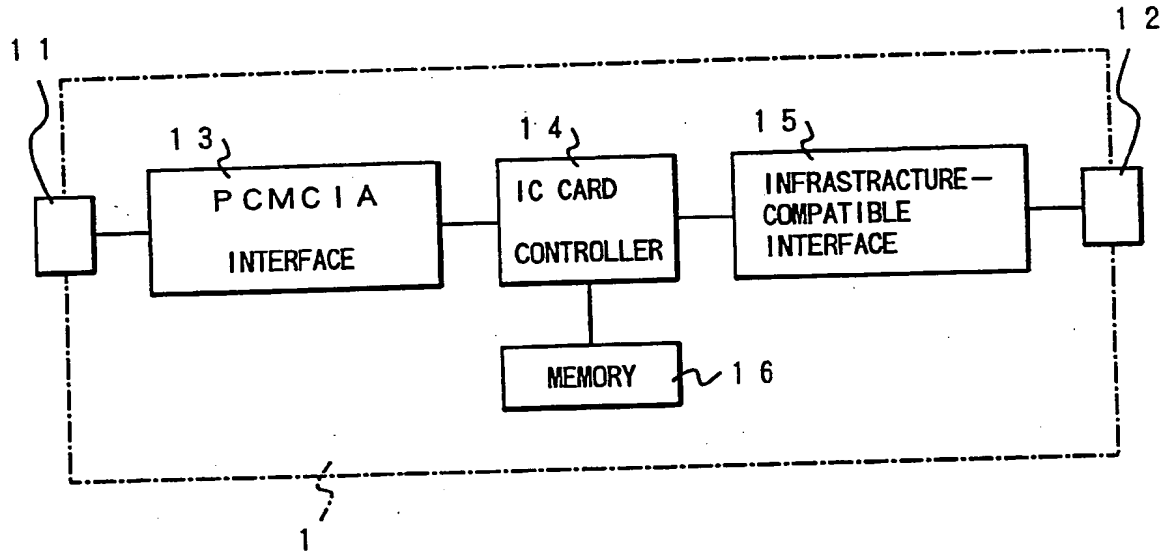

11
12
13
PCMCIA INTERFACE
14
IC CARD CONTROLLER
15
INFRASTRACTURE-COMPATIBLE INTERFACE
MEMORY
16
1

FIG. 3

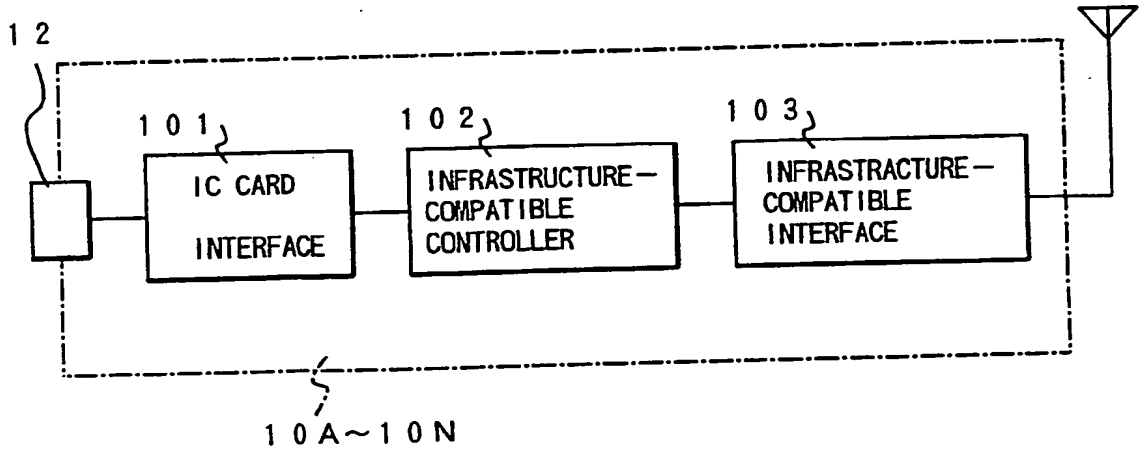

12
101
IC CARD INTERFACE
102
INFRASTRUCTURE-COMPATIBLE CONTROLLER
103
INFRASTRACTURE-COMPATIBLE INTERFACE
10A~10N

FIG. 4

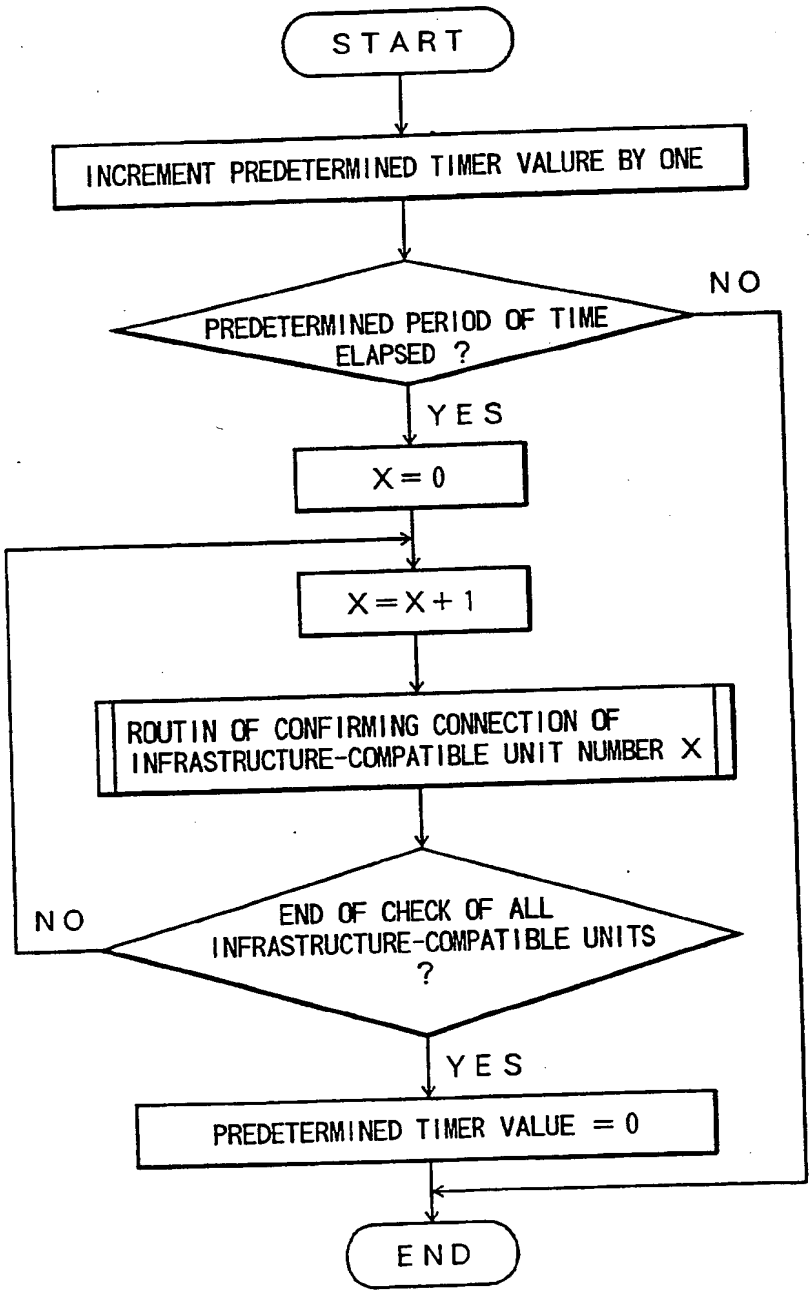

START
INCREMENT PREDETERMINED TIMER VALURE BY ONE
PREDETERMINED PERIOD OF TIME ELAPSED ?
NO
YES
X=0
X=X+1
ROUTIN OF CONFIRMING CONNECTION OF INFRASTRUCTURE-COMPATIBLE UNIT NUMBER X
END OF CHECK OF ALL INFRASTRUCTURE-COMPATIBLE UNITS ?
NO
YES
PREDETERMINED TIMER VALUE = 0
END

FIG. 5

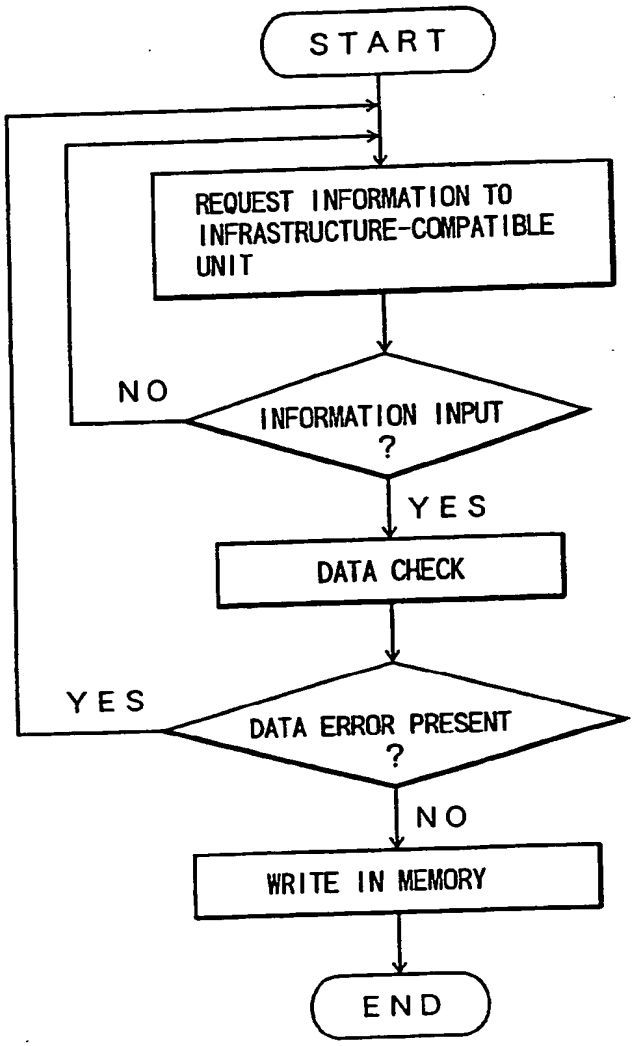

START
REQUEST INFORMATION TO INFRASTRUCTURE-COMPATIBLE UNIT
NO
INFORMATION INPUT ?
YES
DATA CHECK
YES
DATA ERROR PRESENT ?
NO
WRITE IN MEMORY
END

FIG. 6

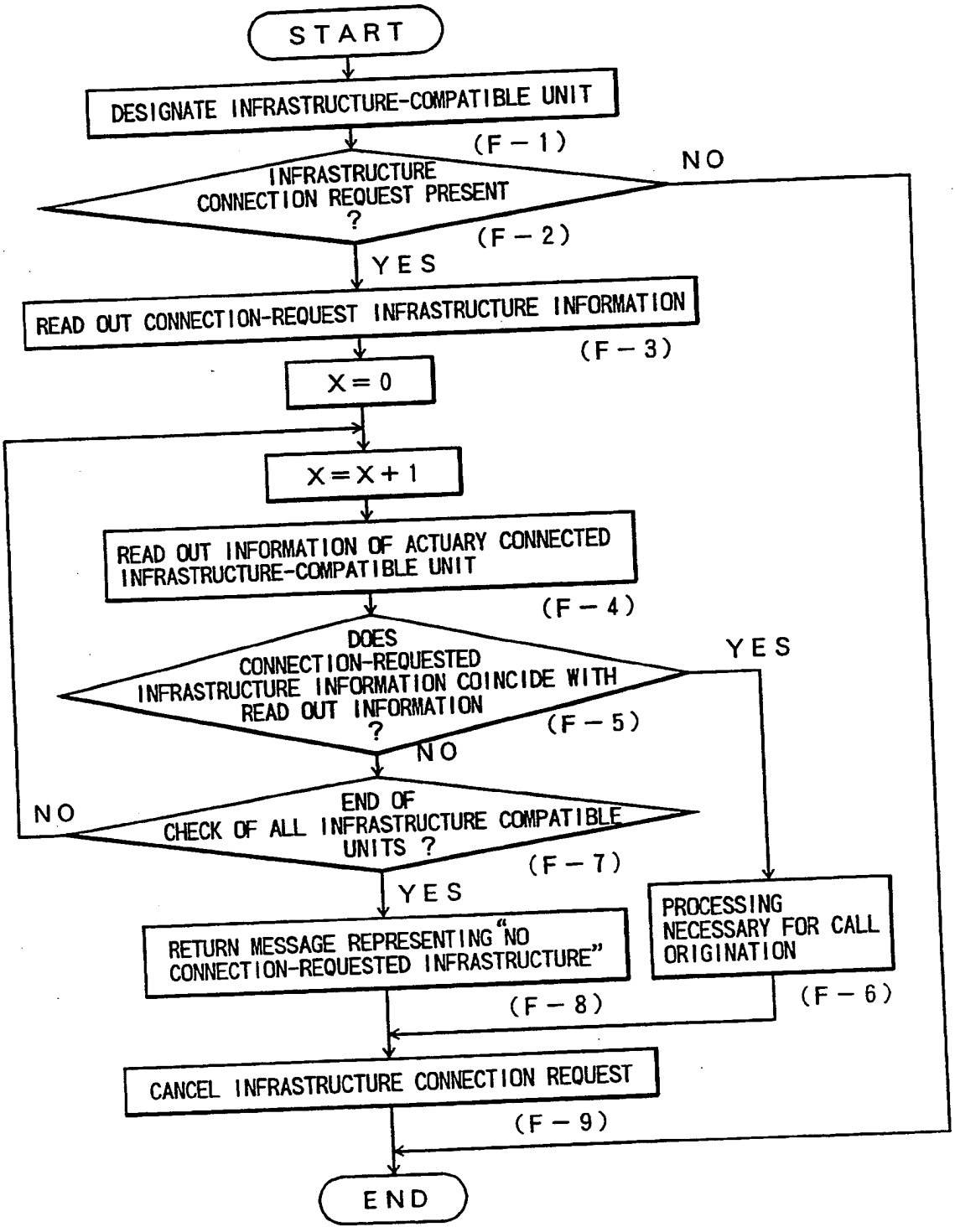
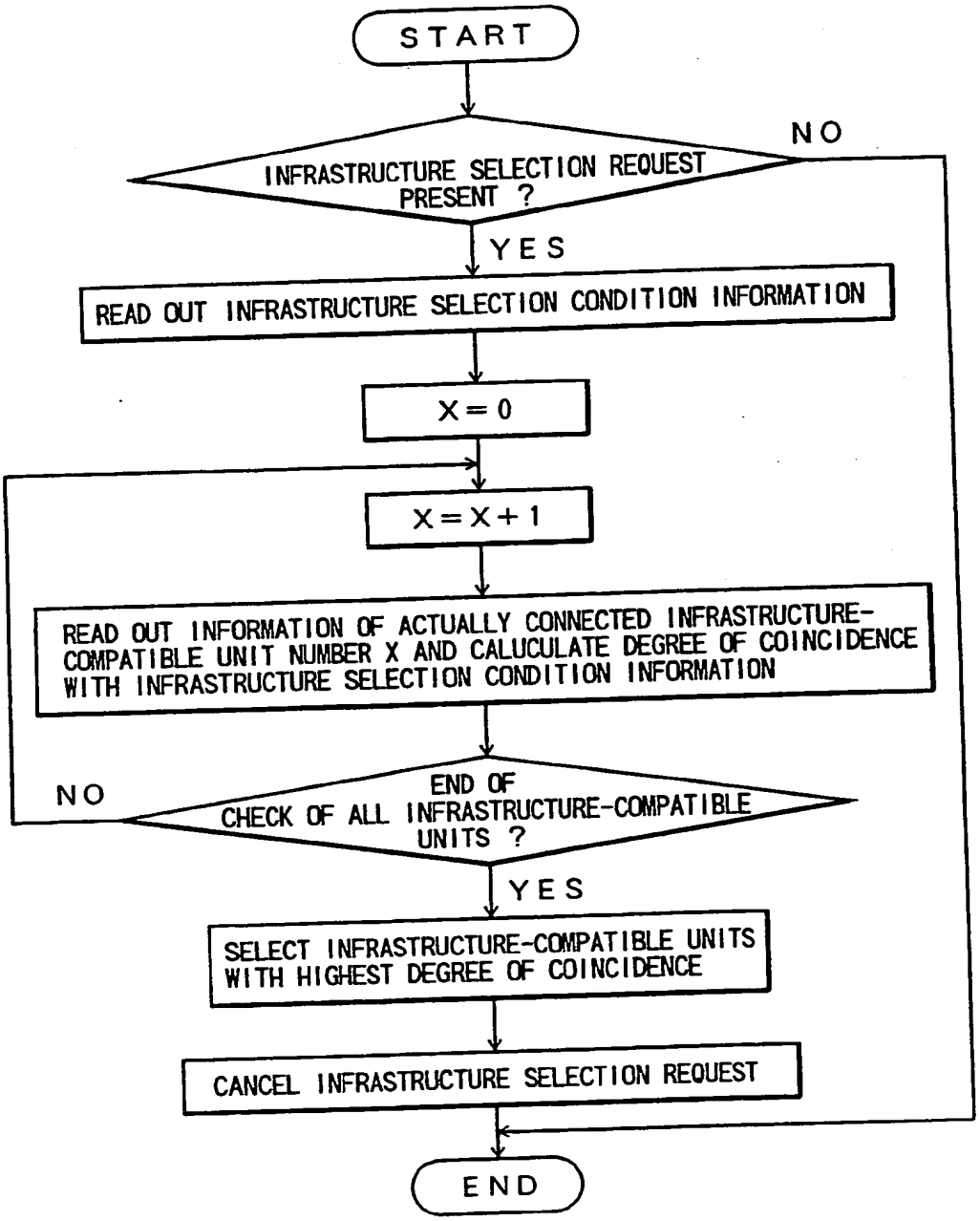

START
DESIGNATE INFRASTRUCTURE-COMPATIBLE UNIT
(F－1)
INFRASTRUCTURE CONNECTION REQUEST PRESENT ?
NO
(F－2)
YES
READ OUT CONNECTION-REQUEST INFRASTRUCTURE INFORMATION
(F－3)
X＝0
X＝X＋1
READ OUT INFORMATION OF ACTUARY CONNECTED INFRASTRUCTURE-COMPATIBLE UNIT
(F－4)
DOES CONNECTION-REQUESTED INFRASTRUCTURE INFORMATION COINCIDE WITH READ OUT INFORMATION ?
YES
(F－5)
NO
END OF CHECK OF ALL INFRASTRUCTURE COMPATIBLE UNITS ?
NO
(F－7)
YES
RETURN MESSAGE REPRESENTING "NO CONNECTION-REQUESTED INFRASTRUCTURE"
(F－8)
PROCESSING NECESSARY FOR CALL ORIGINATION
(F－6)
CANCEL INFRASTRUCTURE CONNECTION REQUEST
(F－9)
END

FIG. 7


START
INFRASTRUCTURE SELECTION REQUEST PRESENT ?
NO
YES
READ OUT INFRASTRUCTURE SELECTION CONDITION INFORMATION
X=0
X=X+1
READ OUT INFORMATION OF ACTUALLY CONNECTED INFRASTRUCTURE-COMPATIBLE UNIT NUMBER X AND CALUCULATE DEGREE OF COINCIDENCE WITH INFRASTRUCTURE SELECTION CONDITION INFORMATION
END OF CHECK OF ALL INFRASTRUCTURE-COMPATIBLE UNITS ?
NO
YES
SELECT INFRASTRUCTURE-COMPATIBLE UNITS WITH HIGHEST DEGREE OF COINCIDENCE
CANCEL INFRASTRUCTURE SELECTION REQUEST
END

IC CARD RADIO MODEM AND COMMUNICATION SYSTEM USING THE SAME

The present invention relates to an IC card radio modem usable in combination with a plurality of infrastructure-compatible units and a communication system using this modem and, more particularly, to an IC card radio modem which accommodates a plurality of connectable infrastructure-compatible units in a single dedicated package (modem main body) to realize communication with an infrastructure network which is arbitrarily selected from an IC card unit side, and a communication system using this modem.

A conventional IC card radio modem of this type has a structure in which an IC card unit and an infrastructure-compatible unit compatible with a single infrastructure network form a pair (set) inside or outside the card, as disclosed in, e.g., Japanese Unexamined Patent Publication No. 2-268390.

In the above-described conventional IC card radio modem, the IC card main body and the infrastructure-compatible unit are paired. For this reason, if a system unit

accommodating and using an IC card radio modem performs communication through a different network, the IC card radio modem must be exchanged for one corresponding to the type of the infrastructure network for communication. Therefore, the conventional IC card radio modem cannot cope with a requirement for communication with an arbitrary infrastructure network in accordance with command control or the like from the system unit.

The present invention has been made in consideration of the above situation in the prior art, and has as its object to provide an IC card radio modem which allows data communication with one infrastructure arbitrarily selected from a plurality of infrastructures by using the IC card radio modem in the same system unit without exchanging the IC card, and a communication system using this modem.

In order to achieve the above object, according to the first aspect of the present invention, there is provided an IC card radio modem comprising an IC card unit storing infrastructure type information in a memory, a plurality of infrastructure-compatible units connected to the IC card unit at multiple points through an IC card interface, and an antenna for sending information to a designated external infrastructure.

According to the second aspect of the present inven-

tion, there is provided an IC card radio modem wherein the plurality of infrastructure-compatible units according to the first aspect are accommodated in a modem main body incorporating the antenna and having a slot for receiving the IC card unit.

The IC card unit according to any one of the first and second aspects is constituted by a PCMCIA interface, an IC card controller, connected to the PCMCIA interface, for controlling an entire IC card, the memory connected to the IC card controller, and an infrastructure-compatible interface connected to the IC card controller. In addition, each of the plurality of infrastructure-compatible units is constituted by an IC card interface connected to the IC card unit and connection-controlled by predetermined control procedures, an infrastructure-compatible controller connected to the IC card interface, and an infrastructure network-compatible interface connected to the infrastructure-compatible unit.

According to the third aspect of the present invention, there is provided a communication system using an IC card radio modem, comprising an IC card unit storing infrastructure type information in a memory, a system unit, connected to the IC card unit through an interface having an interface function based on a PCMCIA standard, for inputting a command related to a start of data communication and designation of

a to-be-used infrastructure, and a plurality of infrastructure-compatible units connected to the IC card unit at multiple points through an IC card interface, wherein communication through an arbitrary infrastructure-compatible unit selected from the IC card unit side is allowed.

According to the fourth aspect of the present invention, there is provided a communication system wherein the plurality of infrastructure-compatible units according to the third aspect are accommodated in a modem main body incorporating the antenna and having a slot for receiving the IC card unit.

The IC card unit according to any one of the third and fourth aspects is constituted by a PCMCIA interface, an IC card controller, connected to the PCMCIA interface, for controlling an entire IC card, the memory connected to the IC card controller, and an infrastructure-compatible interface connected to the IC card controller. In addition, each of the plurality of infrastructure-compatible units is constituted by an IC card interface connected to the IC card unit and connection-controlled by predetermined control procedures, an infrastructure-compatible controller connected to the IC card interface, and an infrastructure network-compatible interface connected to the infrastructure-compatible unit.

As described above, the IC card radio modem of the

present invention has an IC card unit accommodated in a system unit and a plurality of infrastructure-compatible units corresponding to different infrastructure network as a radio modem. The infrastructure-compatible unit to be used for data communication can be switched in accordance with to-be-used infrastructure designation information from the system unit without exchanging the IC card which has been mounted in the system unit, thereby smoothly performing data communication through a radio channel.

The above and many other advantages, features and additional objects of the present invention will become manifest to those versed in the art upon making reference to the following detailed description and accompanying drawings in which preferred structural embodiments incorporating the principles of the present invention are shown by way of illustrative example.

Fig. 1 is a block diagram showing the entire arrangement of an embodiment related to a communication system of the present invention;

Fig. 2 is a block diagram showing the arrangement of an IC card unit;

Fig. 3 is a block diagram showing the arrangement of an infrastructure-compatible unit;

Fig. 4 is a flow chart showing the operation procedures

of a polling sequence;

Fig. 5 is a flow chart showing the operation procedures of a confirmation sequence;

Fig. 6 is a flow chart showing the operation procedures related to designation of the infrastructure-compatible unit; and

Fig. 7 is a flow chart showing the operation procedures related to selection of the infrastructure-compatible unit.

The present invention will be described in more detail with reference to an embodiment shown in the accompanying drawings.

Fig. 1 is a block diagram showing an embodiment of the present invention related to a communication system using an IC card radio modem 2. Fig. 1 also shows a detailed example of the IC card radio modem 2 constituted by actually connecting an IC card unit 1 and a plurality of infrastructure-compatible units 10A to 10N to each other.

More specifically, one side of the IC card unit 1 is accommodated in a system unit (e.g., a personal computer) 3 having an IC card insertion slot so as to be connected to the system unit 3. At the same time, the other side of the IC card unit 1 can be connected to the plurality of different infrastructure-compatible units 10A to 10N. These infrastructure-compatible units are constituted to be

compatible with various infrastructure networks as a radio modem, as a matter of course.

As a detailed structure of the IC card radio modem 2, the single IC card unit 1 is inserted into an insertion slot portion formed in a package (modem main body) accommodating the plurality of infrastructure-compatible units 10A to 10N and an antenna such that multipoint connection between the single IC card unit 1 and the plurality of infrastructure-compatible units 10A to 10N is achieved. Multipoint connection may be achieved simply by a connector cable or the like.

Fig. 2 is a block diagram showing an embodiment related to the detailed structure of the IC card unit 1. The IC card unit 1 is constituted by a PCMCIA interface 13 serving as a system unit interface, an IC card controller 14 for performing control as an IC card unit, a memory 16 connected to the IC card controller 14, and an infrastructure-compatible interface 15 connected to the IC card controller 14. The IC card unit 1 also has a first connector 11 connected to the system unit 3 and a second connector 12 connected to the infrastructure-compatible units 10A to 10N.

Fig. 3 is a block diagram showing the arrangement of the infrastructure-compatible units 10A to 10N for realizing a radio infrastructure interface function to constitute the

IC card radio modem 2. Each of the infrastructure-compatible units 10A to 10N is constituted by an IC card interface 101, connected to the IC card unit 1, for returning applied infrastructure type information, an infrastructure-compatible controller 102, and an infrastructure-compatible interface 103 serving as an infrastructure network interface. A radio communication antenna may be commonly used depending on the types of infrastructures.

The operation of the communication system of the present invention using the IC card radio modem 2 will be described below with reference to Figs. 4 to 7.

The IC card unit 1 and the infrastructure-compatible units 10A to 10N are connected to each other in a one-to-N correspondence by a connecting method such as multipoint or star connection. Whether the plurality of infrastructure-compatible units 10A to 10N are connected can be confirmed by a polling sequence, which is sequentially performed on the basis of a request from the IC card unit 1 (IC card controller 14).

Fig. 4 is a flow chart showing an operation flow related to the polling sequence. In this polling sequence, a confirmation sequence shown in Fig. 5 is sequentially performed for the plurality of infrastructure-compatible units 10A to 10N every predetermined period of time.

In the confirmation sequence shown in Fig. 5, it is

confirmed whether the infrastructure-compatible unit connected through the IC card unit 1 in accordance with a command from the system unit 3 is a desired to-be-selected infrastructure-compatible unit. A request is issued to the connected infrastructure-compatible unit to read out information from the IC card unit side. The readout information is checked to confirm the specific type of the connected infrastructure. The confirmation result is stored (memorized) in the memory 16 in accordance with a command from the IC card controller 14 in the IC card unit 1.

A method of designating the infrastructure-compatible unit for data communication by the communication system of the present invention will be described below with reference to a flow chart in Fig. 6.

The to-be-used infrastructure-compatible unit, which is made into a general classification such as, for example, a network used for a facsimile or a cellular phone, is designated by the system unit 3 (F-1), and at the same time, a command for a start of data communication is input through the PCMCIA interface 13 (F-2). The IC card controller 14 reads out applied infrastructure information stored in the memory 16 on the basis of the command from the system unit 3 (F-3). The infrastructure information of the actually connected infrastructure-compatible unit is read out (F-4). The readout infrastructure information is compared with the

connection-requested infrastructure information which is read out from the memory 16 to check whether these pieces of information coincide with each other (F-5). If YES in step F-5, processes necessary for call origination are performed to realize data communication (F-6). If NO in step F-5, information check for the remaining unconfirmed infrastructure-compatible units is performed, as described in the above polling sequence (F-7). If no information coincident with the infrastructure information read out from the memory is found upon completion of information check related for all the infrastructure-compatible units, a message representing "no connection-requested infrastructure" is output (F-8), thereby canceling the infrastructure connection request (F-9).

Fig. 7 is a flow chart showing operation procedures related to selection of the infrastructure-compatible unit to be used for desired data communication.

Assume that no detailed selection of the to-be-used infrastructure is conducted upon reception of a command for data communication from the system unit 3. For example, any group is not selected from the groups of GI to GIV even if a network for a facsimile is designated by the system unit 3 as the to-be-used infrastructure. In this case, a predetermined selection method may be used to select infrastructure characteristics as parameters from pieces of

information classified by the types of infrastructures such that an infrastructure which allows data communication at the highest speed is used, or an infrastructure with the lowest data communication fee is used. Alternatively, an initialization value table may be formed in the memory 16 of the IC card unit 1, and an initialization value may be set, thereby selecting an arbitrary infrastructure network by the IC card controller 14 in accordance with the scheme of the set initialization value. Either method can more flexibly cope with the control program of the IC card controller 14.

CLAIMS

1. An IC card radio modem comprising an IC card unit storing infrastructure type information in a memory, a plurality of infrastructure-compatible units connected at multiple points to said IC card unit through an IC card interface, and an antenna for sending information to a designated external infrastructure.

2. A modem according to claim 1, wherein said plurality of infrastructure-compatible units are accommodated in a modem main body incorporating said antenna and having a slot for receiving said IC card unit.

3. A modem according to claim 1, wherein said IC card unit is constituted by a PCMCIA interface, an IC card controller, connected to said PCMCIA interface, for controlling an entire IC card, said memory connected to said IC card controller, and an infrastructure-compatible interface connected to said IC card controller.

4. A modem according to claim 2, wherein said IC card unit is constituted by a PCMCIA interface, an IC card controller, connected to said PCMCIA interface, for controlling an entire IC card, said memory connected to said IC card controller, and an infrastructure-compatible interface connected to said IC card controller.

5. A modem according to claim 1, wherein each of said plurality of infrastructure-compatible units is constituted

by an IC card interface connected to said IC card unit and connection-controlled by predetermined control procedures, an infrastructure-compatible controller connected to said IC card interface, and an infrastructure network-compatible interface connected to said infrastructure-compatible unit.

6. A modem according to claim 2, wherein each of said plurality of infrastructure-compatible units is constituted by an IC card interface connected to said IC card unit and connection-controlled by predetermined control procedures, an infrastructure-compatible controller connected to said IC card interface, and an infrastructure network-compatible interface connected to said infrastructure-compatible unit.

7. A communication system using an IC card radio modem, comprising an IC card unit storing infrastructure type information in a memory, a system unit, connected to said IC card unit through an interface having an interface function based on a PCMCIA standard, for inputting a command related to a start of data communication and designation of a to-be-used infrastructure, and a plurality of infrastructure-compatible units connected to said IC card unit at multiple points through an IC card interface, wherein communication through an arbitrary infrastructure-compatible unit selected from said IC card unit side is allowed.

8. A system according to claim 5, wherein said plurality of infrastructure-compatible units are

accommodated in a modem main body incorporating said antenna and having a slot for receiving said IC card unit.

9. A system according to claim 7, wherein said IC card unit is constituted by a PCMCIA interface, an IC card controller, connected to said PCMCIA interface, for controlling an entire IC card, said memory connected to said IC card controller, and an infrastructure-compatible interface connected to said IC card controller.

10. A system according to claim 8, wherein said IC card unit is constituted by a PCMCIA interface, an IC card controller, connected to said PCMCIA interface, for controlling an entire IC card, said memory connected to said IC card controller, and an infrastructure-compatible interface connected to said IC card controller.

11. A system according to claim 7, wherein each of said plurality of infrastructure-compatible units is constituted by an IC card interface connected to said IC card unit and connection-controlled by predetermined control procedures, an infrastructure-compatible controller connected to said IC card interface, and an infrastructure network-compatible interface connected to said infrastructure-compatible unit.

12. A system according to claim 8, wherein each of said plurality of infrastructure-compatible units is constituted by an IC card interface connected to said IC card unit

and connection-controlled by predetermined control procedures, an infrastructure-compatible controller connected to said IC card interface, and an infrastructure network-compatible interface connected to said infrastructure-compatible unit.

13. An IC card radio modem as described with reference to and as shown in the accompanying Figures.

14. A communication system using an IC card radio modem as described with reference to and as shown in the accompanying Figures.

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Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

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Relevant Technical Fields

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Search Examiner
MR M J BILLING

Date of completion of Search
21 FEBRUARY 1995

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASES: WPI

Documents considered relevant following a search in respect of Claims :-
1 to 12

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
A,P	WO 94/21058 A1	(ERICSSON) Figures 1-4; Abstract, page 7 line 27 to page 12 line 24, page 19 lines 4 to 9. Published 15 September 1994	1, 3, 4, 7
A,P	WO 94/10774 A1	(NORAND) Figure 4; page 8 line 30 to page 9 line 35, page 23 lines 11 to 25. Published 11 May 1994	1, 7
A	WO 93/13610 A1	(MOTOROLA) Figure 6; Abstract	1, 7

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